Digitized by the Internet Archive
in 2012 with funding from
LYRASIS members and Sloan Foundation

http://archive.org/details/spraycalendar1920brit

1921 CALENDAR 1921

Bulletin 224

JANUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

FEBRUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

MARCH

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

APRIL

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

MAY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

JUNE

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

JULY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

AUGUST

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

SEPTEMBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

OCTOBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

NOVEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

DECEMBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

43 E22 no.224

FOREWORD.

This is the fifth revision of the Connecticut Agricultural Experiment Station's Spray Calendar; the first having been issued in 1904 as Bulletin 142 and others as Bulletins 159, 183, and 199.

The present edition is slightly revised and enlarged. It includes brief descriptions, with preventive measures, of those insects and fungi and of a few lower animals and environmental conditions which most often injure or destroy crops.

Fuller statements concerning these foes will be found under the references given at the end of the various descriptions.

While primarily designed for Connecticut conditions the information is largely applicable to most of the northeastern states.

The enormous amount of damage caused by insects annually in the United States has been estimated at $1,000,000,000.00 and a similar loss is due to plant diseases. Through proper treatment by spraying and other methods this loss can be greatly reduced. The information given in this calendar will aid you in defeating these enemies. Hang up the Calendar in a convenient place, near your desk, so that it can be consulted as needed. When it comes to treatment of pests, remember the adage, "A stitch in time saves nine." Send specimens and write for further information at any time to

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION,
New Haven, Conn.

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate and 50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime.
100 gals. Water.

Spray upon foliage to kill potato beetle, elm leaf beetle, and all chewing insects. Commonly used with Bordeaux mixture on potatoes, largely superseded by lead arsenate.

CALCIUM ARSENATE.

1½ lbs. Dry Calcium Arsenate. 1½ lbs. Dry Air-Slaked Lime.
50 gals. Water.

Applied as dust or spray on potatoes. May be used in Bordeaux mixture. Not safe on fruit trees.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 oz. White Arsenic or Paris Green.
1 pint Cheap Molasses. 1 Lemon. 7 pints Water.

Mix to form a dry mash and scatter around in field to kill cut-worms, army worms and grasshoppers.

HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other saw-fly larvae.

LIQUID LIME-SULPHUR.

Winter Spray.
1 part Lime and Sulphur. 9 parts Water.
Summer Spray.
1¼ to 1½ parts Lime and Sulphur. 45 to 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

NICOTINE SOLUTION.

½-¾ pint in 50 gals. Water. Dissolve a 1 inch cube of Laundry Soap and add for a Spreader.

Several solutions are now sold containing 40% or more of nicotine. Excellent for killing aphids and other sucking insects.

KEROSENE EMULSION.

2 gals. Kerosene. 1 lb. Common Soap. 1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed which thickens on cooling. Dilute *nine* times before using for most aphids, but may be used stronger or weaker.

MISCIBLE OILS.

Several miscible oils are on the market, such as "Scalecide" and "Jarvis Compound," for killing San José scale, especially on old apple trees, mix 1 part in 15 parts water.

COMMON LAUNDRY SOAP.

Spray 1 lb. dissolved in 8 gals. water upon foliage to kill red spider, aphids, and other sucking insects.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 100 cubic feet of space. Expose for about 36 hours.

PARADICHLOROBENZENE.

A granular solid chemical which gives off fumes fatal to insect life. Has recently been used successfully to control the peach borer.

NAPHTHALENE.

Used in the form of moth-balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin. ½ cup Sweet Milk.
½ cup Water.

Mix and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

ANT POISON.

Arsenate Soda 125 grains. Sugar 1 pound. Honey 1 tablespoonful.
Water 1 quart.

Add arsenate soda and sugar to water. Boil until both are dissolved, then add honey. When cool, place in shallow dishes with a crust of bread or bits of sponge.

HYDROCYANIC ACID GAS.

1 oz. Sodium Cyanide. 2 oz. Sulphuric Acid. 4 oz. Water.
For each 100 cu. ft. space.

For fumigating dormant nursery stock or buildings, place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space; avoid sunlight; excessive moisture; driving winds. Fumigate, between 52° and 70°F.

FORMULAS FOR COMMON FUNGICIDES.

LIQUID LIME-SULPHUR.

Winter Spray.
1 part Lime and Sulphur. 9 parts Water.
Summer Spray.
1¼ to 1½ parts Lime and Sulphur. 45 to 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

DRY LIME-SULPHUR.

There are now on the market several forms of lime-sulphur or similar fungicides, such as B. T. S., that because of convenience in shipping and handling are replacing somewhat the more bulky liquid fungicides. Where experience has shown that spray injury does not result from their use, they may well be substituted for the latter. Use according to directions given by the manufacturers.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime.
8 lbs. Fine Sulphur. 45 to 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

A very excellent substitute for this fungicide is the commercial article called "Atomic Sulphur," especially on peaches where it should be used without lead arsenate at the rate of 8 lbs. to 50 gallons water.

SULPHUR DUST.

Dusting with special grades of very fine sulphur, about 90 parts thoroughly mixed with 10 parts lead arsenate for apples and 80 parts sulphur and 20 parts air-slaked lime for peaches, or with special material prepared by manufacturers, has attained some prominence as a combined fungicidal and insecticidal treatment for fruit trees. Experience so far in this state seems to show that such treatment is much more effective in controlling insects than fungous troubles of the apple. Good results in controlling peach scab and fair results for brown rot are claimed by some authorities. Dusting is much quicker and so cheaper as regards labor, but the cost of material used is considerably greater.

BORDEAUX MIXTURE.

4 lbs. Copper Sulphate.
4 lbs. Fresh Lime. 40 to 50 gals. Water.

Dissolve the copper sulphate in hot water or from a coarse bag suspended in cold water; slake the lime separately and strain. Dilute the latter to about 20 gals., into which pour the copper sulphate, diluted to about 20 gals., stirring the mixture; dilute further to form the forty-five or fifty gallons; or dilute each to 25 gals., and pour together into barrel.

Stock solutions of the copper sulphate and lime, rate 1 lb. to 1 gal. water, can be made separately and used as needed. In this case four gallons of the stock lime is strained into the spray barrel while half filling it with water and then the four gallons of copper sulphate solution are gradually poured in as the barrel is filled to 50 gallons.

FORMALIN.

A. 1 pt. (1 lb.) formalin in 50 gals. water, for sprinkling grain to kill smut. See Smut under Oats.

B. 1 pt. undiluted formalin is *sprayed* directly on 50 bushels of grain as it is shoveled over and then heaped in a pile and covered for four hours.

C. 1 pt. formalin in 30 gals. water; soak uncut tubers 1 hour to prevent potato scab.

D. 1 pt. formalin in 12½ gals. water, for soil treatment. Use two-thirds to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards and stir soil: allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

CORROSIVE SUBLIMATE.

4 oz. Corrosive Sublimate. 30 gallons Water.

Dissolve the corrosive sublimate at first in a small amount of *hot* water and then dilute. Soak uncut seed potatoes in this for ½ to 1 hour. After each treatment renew strength by adding 1 oz. of corrosive sublimate and water as needed to retain the 30 gallons. Use in wooden containers and mark *Poison*. Good for both scab and black scurf.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Soda Bordeaux Mixture. 4 lbs. copper sulphate, 1⅛ to 1½ lbs. soda lye, 50 gals. water. Use only enough lye to make the solution alkaline to test paper. Used sometimes for late spraying of grapes, etc., where spray sediment is objectionable. Care needed in making to avoid spray injury.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil, cool slightly, add 1 lb. soda lye, sitrring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

AMM. SOL. COP. CARBONATE.

5 ozs. Copper Carbonate. 3 pts. Ammonia. 45-50 gals. Water.

Use *just enough* ammonia (if strong, dilute with several volumes of water) to dissolve the copper carbonate; then dilute to final volume. This fungicide is not as good as Bordeaux, but is used to avoid sediment on the foliage or fruit.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes though rarely used on foilage.

COPPER LIME-SULPHUR.

2 lbs. Copper Sulphate. 1½ gals. liquid Lime-Sulphur. 45-50 gals. Water.

Dissolve copper sulphate in part of the water, and then add with the lime-sulphur to the remainder. Apparently a good fungicide but likely to russet apples as does strong Bordeaux.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

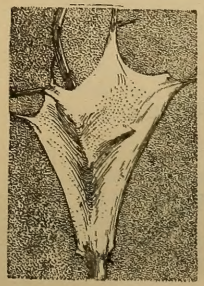
INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

APPLE.

Insects, etc.

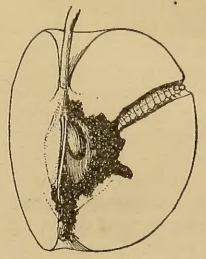
Bud-Moths: Case Bearers: Leaf Crumpler:—Small overwintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.

Canker-Worms—During May small looping caterpillars devour the leaves and spin down on threads when disturbed. Spray foliage with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards sticky tanglefoot bands should be placed around trunks of trees in October, kept sticky until January 1st, and again kept sticky during April and May. Rept. 1908, p. 777.



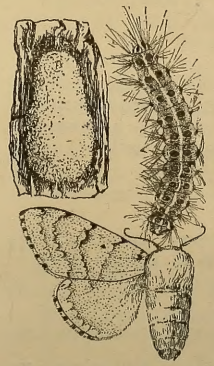
Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before the blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.

Lesser Apple Worm—Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray twice as for codling-moth. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 595.



Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three and six weeks later. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.



Gipsy Moth—Occurs in the United States only in south-eastern New England, New York and New Jersey. Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot, and with burlap, which should be examined each day to destroy caterpillars. From August to May egg-masses can be destroyed by soaking them with creosote. Spray foliage with lead arsenate. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300; also placard.

Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray twice after blossoms fall as for codling-moth, and remove infested fruit in thinning. Keep fence rows clear of trash. Rept. 1904, p. 219.

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars all feed upon foliage and immature fruit. Spray with lead arsenate, as for codling-moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for codling-moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105; 1917, p. 325.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274; 1917, pp. 328, 329.

Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Adult flies may be killed by late sprays of lead arsenate. Rept. 1910, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leaf Hoppers—Whitish insects sucking sap from underside the leaves. Spray with nicotine solution, as for aphis.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray with nicotine solution as for aphis.

Red Spider: Clover Mite: European Red Mite—Cause much injury to leaves, especially in dry seasons. Overwintering eggs killed by winter spray of lime-sulphur.

Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Use delayed dormant spray with nicotine solution ($\frac{1}{2}$ pint in 50 gallons water), either separately or in combination with lead arsenate, lime-sulphur or Bordeaux mixture. Repts. 1903, p. 259; 1909, p. 343.

San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.

Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphis throwing the spray against the tree from opposite directions at the same time. Rept. 1917, pls. II-III.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying small feeding roots. Plant only clean or fumigated stock. Soak soil with carbon disulphide, $\frac{1}{2}$ ounce in 4 gals. water. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color

as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.

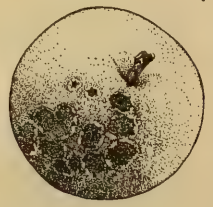
Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous, but apparently a physiological disease. Thought by some to be due to unusual local loss of water; similar troubles may start from punctures of rosy aphis or other puncturing insects. No remedy known, except possibly irrigation in the west.

Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark, which each year is killed a little further, adding another ridge. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to rot, eventually turning it black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909–10, p. 590.

Fruit Specks—Form more or less numerous, small, brown or black spots, starting at surface of fruit and slowly working inward; the Brooks fruit spot often has a pinkish or purplish border in light-skinned varieties. Usually controlled by spraying as for scab. Late spraying is important. Rept. 1909–10, p. 590.

Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered-cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the *cedar-apples*, which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state, as the leaves must be well coated continuously with spray from the time they begin to unfold, until the end of July. Repts. 1891, p. 161; 1909–10, p. 591.



Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Spray the unfolding leaves before the blossoms open, again after the petals fall, and follow with a third spraying about four weeks later. For first treatment, use strong Bordeaux, for second and third, weak Bordeaux or lime-sulphur or the latter for all three treatments. Very susceptible varieties sometimes need four treatments, the last two at intervals of about two weeks. Rept. 1909–10, p. 591.

Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, or often merging together. Spray with Bordeaux as for scab, or with lime-sulphur 1½ to 50. The sprayings after blossoming are the more important. Rept. 1909–10, p. 592; 1911, p. 367.

Blight—See Pear.

Spray Injury—Takes the form usually of burn on leaves and russeting on fruit. Is most likely to occur after second and later sprayings. Worst in wet seasons. Spraying in bright sunshine may cause some scorch of fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux only for *first* summer treatment or on varieties not especially subject to russeting. Rept. 1911, p. 360.

Winter Injury—Takes various forms from different conditions, such as imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened woods, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Rept. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool, well-aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

(1) Winter treatment (spraying dormant trees) is necessary only in the case of the presence of the San José scale, or leaf-blister mite, when commercial lime-sulphur, 1–9, or miscible oils, 1–15, may be used.

(2) As a rule, three summer treatments with a fungicide are necessary to control fungous diseases, and the last two of these should contain an insecticide. These sprayings should be made as follows: 1st, just before the blossoms open, on the young unfolding leaves (April 27th to May 10th, according to the season and variety); 2nd, as soon as all the blossoms have fallen (May 10th to 30th); 3d, about one month later (usually June 10th to 25th).

(3) Where fungi are not prevalent, especially scab, the first summer treatment may be omitted. Occasionally, perhaps in alternative years, where fungi are quite inconspicuous, the fungicide may be entirely omitted, and only the two sprayings with lead arsenate for insects given. With certain fungi and insects a fourth summer spraying is desirable.

(4) For fungicides, we recommend Bordeaux mixture of the 4–4–50 strength for the first spraying, and of the 1–4–50 strength or lime-sulphur for the later sprayings; or lime-sulphur, used at a strength of $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons per fifty gallons of water, for all three sprayings. The former has better fungicidal value, and the latter is less likely to produce spray injury, especially russeting of the fruit. Where fungi are prevalent, the former might be used, while with varieties russeting badly, as Baldwin, the latter is likely to prove more satisfactory in the second and third summer treatments.

(5) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(6) If canker worms, tent-caterpillar, bud-moth, or brown-tail moth are causing damage, add lead arsenate to the first

summer treatment, and if aphids are present nicotine solution should also be included. Nicotine solution may be added to any of the subsequent treatments to detroy aphids, red bugs, tarnished plant bug, etc.

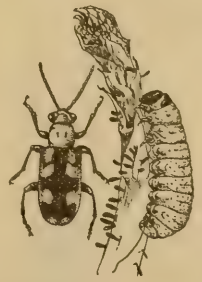
Insects.

ASH

Oyster-Shell Scale—See Apple.

Insects.

ASPARAGUS.



Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate. Repts. 1902, p. 172; and 1903, p. 276.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi.

Rust—Produces (most conspicuous stages) small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with resin Bordeaux partially controls the disease, but this is difficult and expensive. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease or select seed for new stock from resistant individuals if found. This disease is not so serious as it was some years ago. Repts. 1896, p. 281; 1904, p. 313.

Insects.

ASTER.

Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Practice hand-picking and cover choice plants with mosquito netting. Bull. 208, p. 110.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble whose cause is not definitely known. Buy best seed; transplant only healthy plants, and have soil conditions good. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats and Wheat. Rept. 1903, p. 306.

BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Repts. 1908, p. 828; 1919, p. 165.

Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide, store in air slaked lime, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.

Fungi.

Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are forming. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas usually having more of a translucent or watery character. Treat same as anthracnose. Repts. 1898, p. 262; 1903, p. 307.

Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. As the fungus usually appears first and most vigorously in low moist places, the land used should be high or well drained. Serious only in years unusually moist after the middle of July. Spray with Bordeaux beginning about the middle of July, and repeat every 10–14 days until the middle of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall. Rept. 1903, p. 308.

Insects.

BEET-CHARD.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.

BEGONIA.

Eelworms.

Leaf-Blight Eelworm — Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins.

Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate in July. Rept. 1910, p. 701.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1st.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray with lead arsenate when young larvae appear. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stems of blackberries, raspberries and several other hosts. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Forms on leaves small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious but where necessary it probably can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts of the host, so that the disease appears year after year. Dig up and burn infected plants. Rept. 1903, p. 309.

BOX.

Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves.

Oyster-Shell Scale—See Apple.

CABBAGE-CAULIFLOWER.

Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray unheaded plants with lead arsenate. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in

summer, and require same treatment. Bull. 190, p. 12; Rept. 1910, p. 706.

Cabbage Maggot—Infests stems of early-set plants near surface of ground checking growth and often killing them. Practice crop rotation. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Cabbage Aphis—Sucks sap from the leaves. Spray with nicotine solution and soap or with kerosene emulsion. Bull. 190, p. 14.

Fungi, etc.

Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; when possible avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Report 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution and soap, or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select, if feasible, only rust-resisting varieties. Spray in field with Bordeaux, adding 1½ lbs. soap to each 50 gallons (helps mixture to adhere to plants). Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse as dry as is consistent with good growth. One or two sprayings with Soap- or Resin-Bordeaux, after transplanting in greenhouse, may be given if desired; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then as the stem gradually rots off at its base, the whole plant becomes affected and finally dies. Select cuttings only from perfectly healthy plants, and if necessary start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. Spray with lead arsenate.

Fungi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples* if undesirable to destroy the trees. See Apple Rust.

CELERY.

Insects.

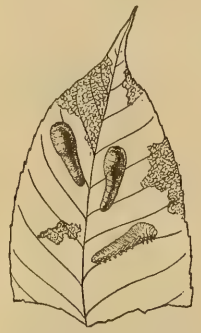
Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy.

Fungi.

Leaf Blight and **Leaf Spot**—Are two diseases showing "rusty" spots on leaves and petioles; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.), often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are often the means of introducing the trouble in the field. If necessary, continue the spraying after transplanting at intervals of about two weeks up to the middle of September. Before covering for bleaching, if leaf spot is abundant, dust with sulphur, and before final storage remove infected leaves and dust again. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil, avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.

CHERRY.



Insects.

Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray or dust with lead arsenate and sulphur.

Canker Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum..

Cherry Aphid—A brown aphid which sucks sap from under side of leaves causing them to curl. Spray with nicotine solution and soap, soap and water, or kerosene emulsion.

Fungi.

Black Knot—Forms knot-like excrescences, usually several inches long, on twigs and branches. When planting, use only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is rarely advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of the mycelial threads in the tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or atomic sulphur helps to keep

new knots from fruiting, but is entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

Brown Rot—See Plum. Rept. 1911, p. 402.

Leaf Spot—Shows as numerous, closely placed, purplish spots on leaves, which often have "shotholes." Spraying, if begun on young leaves early in May, is effective but use the dilute Bordeaux, or better still, self-boiled lime-sulphur or atomic sulphur to avoid injury to the foliage. Give several sprayings at intervals of two weeks. This helps to keep down the brown rot also. Repts. 1895, p. 188; 1911, p. 401. Also known as anthracnose.

Powdery Mildew—Develops a cobweb-like growth over the leaves; in fall forms numerous, minute, black fruiting-bodies, especially on under surfaces. Usually worst in young trees; controlled by spraying if necessary.

Insects.

CHESTNUT-CHINQUAPIN.

Canker Worms—See Apple.

Nut Weevils—Long-nosed snout beetles lay eggs in developing fruit and the grubs infest the nuts. Destroy all infested nuts. Fumigate nuts with carbon disulphide as for beans.

Two-lined Chestnut Borer—Long, slender, flat-headed larvae make sinuous tunnels under bark of weakened chestnut and oak trees. Badly infested trees should be removed and burned, or the bark removed before the insects mature and spread to other trees.

Fungi.

Bark Disease (Blight)—Forms cankers in the bark that eventually girdle infected limb and cause death of parts above. Spreads over tree so that usually it dies within two to five years.

Rarely shade trees can be saved by carefully cutting out and painting over the cankers. For forest trees it is best to let the disease take its course, and remove at least the larger trees within a year or two after their death to prevent deterioration of the wood. Most of the chestnuts in the state have been already killed. Rept. 1912, p. 359; Bull. 178.

CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution and soap.

Gall Midge—Larvae form cone-shaped galls on leaves and new shoots. Spray plants about three times each week with nicotine solution and soap. Rept. 1919, p. 161.

Fungi.

Powdery Mildew—Develops a white mealy or cobweb coating on leaves. Use good judgment in airing and watering, and if necessary, spray from time to time with potassium sulphide or paint heating pipes with sulphur.

Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid worst rusting varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on cuttings. Early sprayings with dilute copper sulphate, potassium sulphide, etc., may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution and soap, or soap and water, as a spray or dip.

CORN.

Insects.

Cut Worms—See Tomato.

Army Worm—See Grass.

Stalk Borer—See Dahlia.

White Grubs—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust the silk with equal parts sulphur and powdered lead arsenate. Rept. 1919, p. 188.

European Corn Borer—Imported into eastern Massachusetts, New York and Canada. Larvae tunnel in all parts of plant above ground. Destroy all infested plants. Rept. 1918, p. 316.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Root and **Ear Rots**—Injures roots and base of stalk with a reddish-brown rot. Stalks are easily broken off and often fail to produce good ears, the worst infected showing a moldy, white or pinkish growth. Plant only vigorous, disease-free seed, practice yearly rotation and do not let corn follow other grains. Bull. 222, p. 427.

Smut—Forms black dusty outbreaks that appear on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Avoid the use of fresh manure on the land. Seed treatment is ineffective. The removal and destruction of spore masses is recommended by some writers.

CRANBERRY.

Insects.

Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.

CUCUMBERS.

Insects.

Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Bull. 216, p. 34; Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs occasionally on fruit. Treatment is the same as for mildew. See Watermelon.

Downy Mildew—Forms discolored spots as in preceding, but beneath shows a minute thin growth of upright threads bearing dark colored spores. Repeated sprayings with Bordeaux about every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. The same fungus occurs on Melons. Rept. 1904, p. 329.

Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

CURRANT.

Insects.

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems, causing the leaves to droop and wilt. Destroy infested canes during May.

Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1896, p. 238.

Currant Aphids—Yellowish-green aphids on under side of leaves causing them to curl. Underspray with nicotine solution or kerosene emulsion.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution and soap. Bull. 208, p. 118.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution and soap. Bull. 143; Rept. 1903, p. 227.

Fungi.

Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until fruit begins to turn. If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants. Alternate host is white pine. Report presence to the Experiment Station. Rept. 1911-12, p. 347. See Pine.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in nicotine solution and soap, 1 part in 400 parts of water. Avoid excessive moisture in house. Rept. 1914, p. 176.

DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution and soap. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer. Bull. 208, p. 111; Rept. 1919, p. 180.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

Fungi.

Fruit Rots—Caused by several fungi, the gray mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster, or spray with lead arsenate. Rept. 1906, p. 260.

Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1st, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnel in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10th with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion.

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves and causing their premature fall. Not usually so injurious as to merit the expense of spraying with Bordeaux, which should start on the immature leaves. Rept. 1909-10, p. 717.

EUONYMUS.

Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Bull. 151; Rept. 1905, p. 240.

FERN.

Insects, etc.

Woolly Bears—Several kinds of light brown hairy caterpillars devour the fronds in late summer. Spray with lead arsenate.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Leaf Mite—See Cyclamen.

Fungi.

Gray Mold Rot—Produces dead spots on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plants; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

Insects.

Currant Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties, also attacks currant, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant.

GRAPE.

Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15th and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with lead arsenate just before blossoms open and if necessary again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than

real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.

Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leaf-Hopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution and soap.

Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; especially bad in rotting the berries, which finally become hard, shrunken and wrinkled, black mummies. This is one of the worst diseases of the grape and often difficult to control by spraying, which must be thorough, especially the first season. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10-14 days. Use Bordeaux up to the last of July and then change to Soda Bordeaux or Amm. Sol. Cop. Carbonate, though usually the 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops usually dense white patches of fruiting threads on under side of leaves and causes more or less discoloration on the upper; also occurs somewhat on stems and fruit. Treat as for black rot. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Repts. 1895, p. 185.

Insects.

GRASS.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1st to expose insects. Harrow very thoroughly before planting. Repts. 1912, p. 288; 1915, p. 179.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be con-

fined to lawns and millet. The worm does not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.

Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march, turning the furrow towards the line. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Repts. 1907, p. 332; 1917, p. 325.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1st, and burned or at least the bark removed. Spray healthy and slightly infested trees about June 1st, with strong lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Nut Weevils—Larvae infest the fruit or nuts. See Chestnut.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large numbers of aphids. Spray with nicotine solution just as new growth starts in spring. Rept. 1916, p. 145.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown outbreaks on both leaves and stems. After their death in fall, cut off the plants close to the ground, carefully gather up these and any rubbish that may contain spores, and destroy them. Spraying with Bordeaux is recommended by some as helpful in checking the rust; begin as plants push through ground. Rept. 1895, p. 188.

HOP.

Insects.

Hop-Vine Borer—Larva tunnels in tip, checking growth, and later in the stem above and below the surface of the ground. Crush larvae in the tips, remove soil from the base, and after leaving the main roots exposed for a week, apply wood ashes or ammoniated phosphate and hill up. The plants will make new roots.

Hop-Vine Snout Moth—Green, white-striped larvae feed upon the leaves in June. Spray with lead arsenate while the larvae are small.

Hop-Merchants—Brown, spiny caterpillars of two species of tortoise-shell butterflies feed upon the leaves. Spray with lead arsenate.

Hop Aphid—Green aphids suck the sap from the under leaf surface. Spray with kerosene emulsion.

Fungi.

Powdery Mildew—Coats leaves and stems with whitish powdery growth, the mature fruiting bodies finally showing as loosely imbedded blackish specks. Found here so far only on ornamental varieties. Make several sprayings with commercial lime-sulphur. Rept. 1911-12, p. 349.

HORSE CHESTNUT.

Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Repts. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf Spot—Forms extended reddish-brown areas on the leaves, frequently resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can no doubt be controlled by spraying with Bordeaux. The first application is made on the unfolding leaves and is followed by one or two subsequently at intervals of about 2 weeks.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

Insects.

Iris Root Borer—Larva tunnels in the rootstocks injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Repts. 1915, p. 189; 1918, p. 331.

Fungi, etc.

Leaf Blight—Forms elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; worst on German Iris. Keep foliage coated with Bordeaux or lime-sulphur, beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks destroying lower parts so that leaves turn yellow and die. Same bacterial disease described under Salsify. Propagate only from healthy stock; plant in well drained soil; use only well rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.

IVY, BOSTON.

Fungi.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. Leaf stage of black rot of grape. Give several sprayings with commercial lime-sulphur, beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion.

Insects. **LETTUCE.**

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula D). Treat some days before using. Parsley is also subject to this disease in the greenhouse. Rept. 1908, p. 863.

Leaf Mold and **Mildew**—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth.

Insects. **LILAC.**

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs. Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but hardly demands preventive treatment.

Insects. **LILY.**

Aphid—Yellow plant lice with red markings, on under side of leaves. Spray with nicotine solution and soap.

Stalk Borer—See Dahlia.

Insects. **LINDEN.**

Canker Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

Insects. **LOCUST.**

Locust Borer—Larvae tunnel in solid wood of trunk. When new leaves appear, spray bark of trunk and larger branches with mixture made by dissolving ¼ lb. sodium arsenite in 5 gallons water to which 1 quart of miscible oil is added and the whole thoroughly agitated.

Insects. **MANGEL.**

Leaf Miner—See Beet.

Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; if necessary spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

Insects.

MAPLE.

Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1907, p. 336.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker Worms—See Apple.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves in midsummer; insects suck out the sap causing leaves to fall prematurely. Males and larvae enter crevices of bark of trunk and branches; larvae make cases here and pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon after the young appear. Spray with miscible oils. Bull. 151; Repts. 1905, p. 237; 1913, p. 252.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 238.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green aphids are common on under surface of leaves of Norway and Sycamore maples in June. Spray with nicotine solution and soap, or with kerosene emulsion.

Gall Mites—Disfigure leaves by forming galls on upper surface. Destroy infested leaves.

Fungi, etc.

Anthracnose—Causes more or less extended dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season and is difficult to foretell, but only occasionally serious. For this reason spraying is of doubtful value in the long run, but when made should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Causes more or less extended and irregular dead areas to appear suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are probably best remedial measures. Rept. 1905, p. 267.

Stag-head—Kills trees at the top or large central branches gradually die. Due to various agents or unfavorable environment such

as parasitic or semiparasitic toadstools and shelf-fungi, escaping gas in soil, winter injury, etc. Cut off dead and dying branches, clean out decaying wood, treat with a wood preservative and if necessary fill cavities. Stimulate new growth by nitrogenous fertilizers.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution and soap. Bull. 216, p. 47; Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber and Watermelon.

Downy Mildew—Forms angular, eventually brown spots in the leaves, often stunting or killing vines; most prominent just before melons ripen, later ones often not maturing or worthless because lacking flavor. It is questionable whether this trouble can be controlled effectively and profitably by spraying during a very moist season. During dry or semi-moist seasons, however, results are satisfactory, so we recommend spraying as one of the regular operations of melon growing. It should be started soon after the vines begin to run, at least by the middle of July, and the vines should be kept covered with the Bordeaux to the end of the season. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves sucking the sap. Spray with nicotine solution and soap.

OAK.

Insects.

Canker Worms—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

White Heart Rot—Forms on trunks shelf-fungi, often somewhat hoof-shaped, eventually with dark, creased and cracked, upper surface and rusty-brown, porous, fruiting, lower surface. Gains entrance through wounded and dead branches; causes white rot of heart wood and slow death of sapwood and bark. Break off and burn fruiting bodies; if feasible cut out diseased bark and sapwood, and dig out dead heartwood and fill cavity with cement. Occurs in other deciduous trees. Bull. 222, p. 446.

OATS.

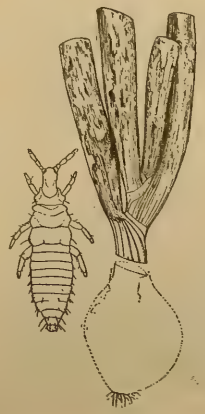
Insects.

Army Worm—See Grass.

Fungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown. Cut out barberries in vicinity of fields.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 8 to 10 minutes in water at 132–5° F., or sprinkle thoroughly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. A less cumbersome treatment coming into general use is that given under formula B. Buy seed from smut-free fields.



ONION.

Insects.

Thrips or **"White Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill over-wintering insects. Spray with nicotine solution and soap, or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.

Fungi, etc.

Anthracnose (Black Spot)—Produces black circular spots on the bulbs, usually on white varieties after storing in the barn. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Possibly air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plants raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If, however, it is seeded, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 or 15 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Repts. 1889, p. 129; 1895, p. 176.

Stem Rot—Causes rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth of mold. This fungus in a moist season occurs on various parts of the plant in

the field (possibly responsible for "blast" of seed onions), but does not usually appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. See Fig. (B) under anthracnose. Repts. 1903, p. 334; 1904, p. 321.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus inconspicuous, may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great injury. Early peas may mature a crop before aphids injure them. Spray vines with nicotine solution and soap. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, emerging through round holes. Fumigate with carbon disulphide. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—The former shows as roundish spots on both pods and leaves; the latter, as a mealy or cobweb-like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

Root-Rot—Kills tops of roots and base of vines, causing parts above to turn yellow, wilt and die prematurely. Caused by various soil fungi of which the downy mildew was especially prominent in 1919. Practice rotation, use *well-rotted* manure and give frequent cultivation in wet years to hasten the drying of the top soil. Bull. 222, p. 450.

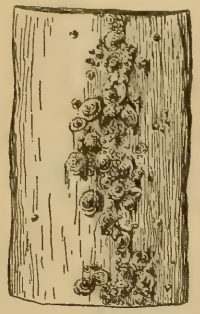
PEACH.

Insects.

Peach Saw-Fly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Remove top soil and sprinkle powdered paradichlorobenzene around the trunk, using about 1 ounce per tree and cover with soil. Rept. 1909, p. 359.

Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.



Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

Fungi, etc.

Brown Rot—Occurs on the young twigs, etc., but causes most serious injury to the fruit, rotting it about the time of its maturity. The rotten areas usually become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. Spraying these apparently pays in this state. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur 1-9. If more convenient this may be done in late fall and is claimed to be just as effective. Same treatment takes care of San José scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs. Give winter treatment as for leaf curl, and, if necessary, summer treatment as for scab and brown rot.

Scab—Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur or atomic sulphur upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur than with same treatment on apple, *q. v.* Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by

its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. See Apple. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit with yellowish curled leaves, and in time spindling sprout growths in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished from yellows, showing chiefly in the small backward fruit. Root out and burn all trees as soon as found; prevent winter injury; be careful in selecting stock for planting. Nurserymen should use especial care in selecting their stock for budding. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying of peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall or early spring, will take care of all of these troubles at the same time. If the scale and the leaf curl are unusually prevalent, both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, it is as a rule desirable to give three sprayings, as follows: 1st, shortly after the blossoms have fallen (May 15th to May 25th); 2nd, about three or four weeks later (June 5th to June 15th); and 3d, about one month later (July 5th to July 15th). If only two sprayings can be given, omit the first if spraying only for rot, and the last if spraying only for scab.

(3) On the whole, self-boiled lime-sulphur of the 8-8-50 formula or atomic sulphur seem to be the safest and most reliable peach sprays. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is recommended.

(4) As lead arsenate has done little to prevent curculio injury, and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger from the sawfly, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Repts. 1901, p. 270; 1917, p. 319.

San José Scale—See Peach.

Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime-

sulphur in spring just before buds open. Spray infested trees with nicotine solution and soap in July. Rept. 1903, p. 262.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds destroying them so that fruit does not set. Spray with nicotine solution and soap just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.

Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray with Bordeaux on unfolding leaves before blossoms open, again after petals fall, and give the third spraying about two weeks later, using weak Bordeaux in last two treatments. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below the diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several times after blossoming remove all young dead twigs. Use knife sterilized from time to time by wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1000). This disease occurs also on apple and quince. Rept. 1894, p. 113.

Leaf Blight—See Quince.

Insects.

PEONY.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

Insects.

PHLOX.

Red Spider—Injures leaves causing them to turn yellow. Clean culture. Spray clear water with force from hose, and in severe infestations, with kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial lime-sulphur, starting before mildew gains much headway.

Insects.

PINE.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate. Rept. 1917, p. 273.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop in it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May, serves to greatly reduce the damage. Infested leaders should be cut and destroyed. Repts. 1911, p. 307; 1919, p. 144.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene

emulsion about the second week in June. Bull. 151; Rept. 1905, p. 240.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Repts. 1911, p. 343; 1919, p. 155.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips inward, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem invading the base of the leaves which wither. Certain conifers are more subject to attack then others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding (see Fungicides, formalin D); spraying with Bordeaux is effective in some cases. Repts. 1912, p. 348; 1915, p. 450.

Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blisterlike spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these (*q. v.*). A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed,

and watch kept of the alternate hosts, if they occur in the neighborhood. Seed beds should never be made in the vicinity of the alternate hosts, as infection takes place easily in the young pine seedlings. Spray beds with Bordeaux if liable to infection. In white pine plantations pull out all currants and gooseberries including those in the immediate neighborhood (500 feet). Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347; Bull. 214, p. 428.

Insects.

PLUM.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution and soap, or with soap and water.

San José Scale—See Peach.

Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control

by spraying, as spray does not readily adhere to the smooth fruit. First treatment with self-boiled lime-sulphur, should be made on half grown fruit, others at intervals of two weeks, and the last one 10-14 days before picking. See Peach.

Crown Gall—Forms hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it except possibly on blackberries and imported roses. It also occurs on peach, apple, raspberry, and various ornamental plants.

Insects.

POPLAR.

Poplar Tent-maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping and painting over exposed wood if surface is extended. Bull. 222, p. 461.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

Insects.

POPPY.

Aphids—Black aphids suck sap from stems and leaves. Spray with nicotine solution and soap.

Insects.

POTATO.

Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate or calcium arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Bull. 208, p. 106; Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate. Bull. 208, p. 109.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines. See Dahlia. Bull. 208, p. 111.

Potato Aphid—Green and pink aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray with soap and nicotine solution. Bull. 208, p. 115.

Fungi, etc.

Black Leg—Causes a black rot of stem below ground; plants more or less stunted with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants appear in the field, not spreading to the healthy. Soaking seed in formalin as for scab said to be helpful. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and often death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1st, and keep vines well covered to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties often escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909–10, p. 739; 1915, p. 470; 1916, p. 355; Bull. 214, p. 411.

Mosiac—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. New here but apparently not so injurious as in some other places. Do not save tubers for planting from hills showing this trouble. Bull. 222, p. 464.

Scab—Produces the common scabby appearance on surface of tubers. Soak uncut seed-tubers one hour in formalin (formula C). Formalin fumes (see Less-Used Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Corrosive sublimate is again recommended by some investigators especially where the black scurf (Rhizoctonia fungus) also occurs on the tubers, as this treatment seems more effective against the latter. Hot corrosive sublimate or formalin for short periods has also been recommended for potato tuber diseases. Avoid planting on infected land, by systematic rotation. The use of lime, wood ashes, and various barnyard manures will increase the amount of scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909–10, p. 744.

Tip Burn—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for blight, as this often helps to increase yield by lengthening life of leaves. Rept. 1909-10, p. 742.

PRIVET.

Insects.

Privet Leaf Folder—Larvae web together terminal leaves and feed inside. Clip off and destroy infested shoots. Spray with lead arsenate. Rept. 1913, p. 223.

Privet or **Lilac Borer**—See Lilac.

Fungi, etc.

Anthracnose—Forms small cankers on stems causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; if bad spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

Insects. **QUINCE.**

Round-Headed Borer—See Apple.

Quince Curculio—Grubs infest growing fruit and adults feed upon it causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate.

Aphid—See Apple.

Fungi, etc.

Black Rot—Rots the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for leaf blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Forms rounded, often confluent, reddish-brown spots with central black dots on leaves and fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with 1 or 2 additional treatments at intervals of about 2 weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders and filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Look for infected cedars in neighborhood. See Apple Rust.

Insects. **RADISH.**

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

Insects. **RASPBERRY.**

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore. Rept. 1918, p. 329.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Raspberry Fruit-Worm—Brown beetles feed upon buds, leaves and blossoms, and white larvae adhere to berries at picking time. Spray with lead arsenate when beetles first appear.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin-Bordeaux. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

Wilt—Forms cankered areas on the canes causing the parts above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. The green berries often dry up without apparent cause, due to inoculation by insects. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Causes foliage to become more or less crinkled, and mottled with a sickly yellowish color. Plants gradually become worthless. Spraying does not seem to help this trouble, which apparently is of similar nature to peach yellows. Dig out plants with the yellows. Propagate only from perfectly healthy ones.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1910, p. 708.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

Rose Midge—Larvae distort young leaves and flower buds in greenhouses. Apply tobacco dust to the soil and fumigate nightly with tobacco stems or nicotine paper.

Rose Chafer—See Grape.

Leaf-Hopper—Sucks the sap from the under side of the leaves. Spray with nicotine solution and soap.

Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solution and soap. Bull. 151, p. 11; Rept. 1905, p. 241.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.

Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially those of Manetti stock. There is some question how much infected plants eventually suffer. See Plum. Rept. 1911-12, p. 355.

Leaf Blotch—Forms large purple-black blotches on leaflets, which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off; occasionally blasts blossoms of certain varieties. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356. Bull. 222, p. 474.

RUTABAGA, See **TURNIP.**

Insects.

RYE.

Army Worm—See Grass.

Wheat Midge—See Wheat.

Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally in cultivated fields. Keep these sclerotia out of cattle feed as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.

Fungi, etc.

SALSIFY.

Soft Rot—Forms a soft rot of the interior tissues of the roots running down from the crown and turning them a darker color. Usually occurs after storage. Same bacteria cause soft rots in a variety of plants. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

Insects, etc.

SNAPDRAGON.

Leaf Mites—Cause leaves to curl and plants do not blossom. Spray with nicotine solution and soap, same as for Cyclamen. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hot-beds as this far north the nematodes are killed in unprotected ground over winter. Attacks roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in summer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often running together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves causing tissues above to become yellow spotted. Appearing in greenhouses and causing more or less injury according to prevalence. Treat as for anthracnose. Rept. 1915, p. 443.

Insects.

SNOWBALL.

Aphids—Suck sap from the leaves causing them to curl. Use nicotine solution and soap as a spray or dip.

Fungi, etc.

SOY BEAN.

Bacterial Leaf Spot—Forms small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties appear more susceptible than others, Ito San being one of the

worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

SPIRAEA.

Insects.

Aphids—Suck sap from the new shoots. Use nicotine solution and soap as a spray or dip.

SPRUCE.

Insects.

Spruce Gall Aphid—Forms galls at the base of the new growth on Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Rept. 1906, p. 302.

Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches causing much damage. Spray with lead arsenate. Rept. 1912, p. 291.

SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; 216, p. 42; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.

Squash Bug or **"Stink Bug"**—A brown bug three-fourths of an inch in length sucks the sap from the under side of the leaves, causing them to wilt and die. Spray with kerosene emulsion to kill the young. The old bugs may be trapped by placing boards or shingles on the ground, which should be visited each morning and the bugs killed. Bull. 216, p. 44; Rept. 1908, p. 811.

Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Cut slits lengthwise in the stem and kill borers. Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Bull. 216, p. 39; Rept. 1908, p. 806.

Fungi.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clog up the water ducts. Fungi in the ducts or insects at the roots may cause similar trouble. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the

bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

Insects. **STRAWBERRY.**

Strawberry Sawflies—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistillate varieties in part. Dust heavily with lead arsenate and sulphur (1–5.)

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields and plow abandoned fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution and soap.

Strawberry White Fly—Sucks sap from leaves. Underspray with nicotine solution and soap.

White Grubs—See Grass.

Fungi.

Leaf Spot and **Blotch**—Cause conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter fungus. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. When necessary, this can probably be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

Insects. **SWEET PEA.**

Aphids—See Pea.

White Fly—See Tomato.

Fungi.

Dampening Off—Rots off stem just below ground causing vines to turn yellow and finally die. Plant in well drained soil; place well rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

Insects. **SWEET POTATO.**

Tortoise-Shell Beetles—Feed upon leaves. Spray with lead arsenate. Bull. 208, p. 110.

Fungi. **SYCAMORE.**

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half grown.

TOBACCO.

Insects.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Cut Worms—See Tomato.

Fungi, etc.

Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a physiological disease, due to injurious enzymes, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

Dampening Off—Due to various fungi which rot off the seedlings close to the ground, and cause them to fall over. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Occasionally it does more or less damage in fields, especially in alkaline or water soaked soils; a short rotation is advisable in such cases. Sterilize seed beds with steam or treat with formalin (formula D). Repts. 1906, p. 342; 1907, p. 363.

Wild Fire—Shows first in lower leaves as small, roundish, yellow spots. In time these grow larger, turn darker, and irregular dead areas appear more or less prominently. This disease is caused by bacteria, is favored by wet weather and is apparently new to the state. It is carried on the seed and later may be readily transferred from infected places in the field by certain insects and the wind. Care should be used to select seed only from disease-free fields and sow this seed in sterilized seed beds. Where doubtful seed is used this should be soaked for 15 minutes in 1 pint of water to which is added 1 oz. of formalin, stirring the seed during the treatment. Drain off the liquid, wash seed in pure water several times and dry before storing. Old cloth used previously on infected beds should be boiled in water before used again.

TOMATO.

Insects.

Cut Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut worms with small

piece of board. Rept. 1906, p. 264; Bulls. 190, p. 18; 208, p. 112; 216, p. 43.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Potato Aphid—See Potato.

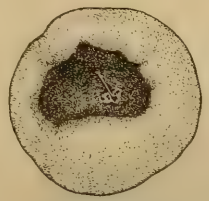
Stalk Borer—See Dahlia.

White Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (1 oz. to 1000 cubic ft.). Bulls. 140; 216, p. 50; Rept. 1902, p. 148.

Fungi, etc.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10-14 days. This usually develops too late in the season here to cause serious damage.



Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying, apparently, is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and slowly wither up; fungus may finally show on dead stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Bull. 151; Repts. 1905, p. 239; 1912, p. 294.

TURNIP-RUTABAGA.

Insects.

Cut Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Underspray with soap and water or nicotine solution. Rept. 1916, p. 98.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

Insects, etc.

VIOLET.

Violet Midge—Larvae in curled edges of new leaves. Fumigate every other night with hydrocyanic acid gas ($\frac{1}{2}$ oz. to 1000 cu. ft.)

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

Insects.

WALNUT.

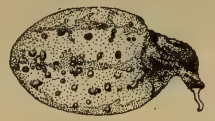
Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Repts. 1914, p. 191; 1917, p. 326.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

Fungi.

WATERMELON.



Anthracnose—Shows as more or less abundant, dark, sunken spots or areas on the fruit. Also infects leaves in spots. Usually appears here too near end of season to cause sufficient injury to warrant spraying; spray also fails to adhere well to the fruit. Rotation and removal of rotting melons from field may possibly be helpful restrictive measures.

Insects.

WHEAT.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant rather late—say about September 1st.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall. Rept. 1917, p. 366.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several

closely related species on barley, rye, and wheat but quite distinct from the black stem rust. Some varieties are more resistant than others to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head turning it into a dusty olive-black mass that is dissipated in time. Severe hot water treatment partially effective. See Oats.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Use formalin treatment. Rept. 1909-10, p. 736.

Insects.

WILLOW.

Fall Web Worm—See Pear.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Sawflies—Larvae devour leaves. Spray with lead arsenate.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution and soap.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar. The alternate host for one species is the larch and apparently there is another whose alternate host is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Aspinwall Manufacturing Co., Jackson, Mich. (Hand and power potato sprayers.)
Barnes Mfg. Co., Mansfield, Ohio. (Hand and power sprayers.)
Bateman Mfg. Co., Grenloch, N. J. (Iron Age sprayers for hand and power.)
Bean Spray Pump Co., Lansing, Mich. (Hand and power outfits.)
Brackett, Shaw & Lunt Co., Somersworth, N. H., 62 No. Washington St., Boston, Mass. (Hand and power outfits.)
Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)
Church, Stephen B., Seymour, Conn., 64 Pearl St., Boston, Mass. (Power and hand sprayers.)
Crestline Mfg. Co., Crestline, Ohio. (Sprayers.)
Cushman Sprayer Co., St. Joseph, Mo. (Power outfits.)
Dayton Manufacturing Co., 2240 East Third St., Dayton, Ohio. (Hand sprayers.)
Deming Co., Salem, Ohio. (Hand and power outfits.)
Douglas, W. & B., Middletown, Conn., (Hand and power pumps.)
Field Force Pump Co., Elmira, N. Y. (Hand and power pumps.)
Fitzhenry-Guptill Co., 135 First St., Cambridge, Mass. (Power sprayers.)
Friend Mfg. Co., Gasport, N. Y. (Power and hand pumps.)
Goulds Mfg., Co., 58 Pearl St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)
Hardie Mfg. Co., Hudson, Mich.; Hagerstown, Md. (Hand and power pumps.)
Hayes Pump and Planter Co., Galva, Ill. (Spray pumps.)
Humphryes Mfg. Co., Mansfield, Ohio. (Hand and power pumps.)
Hurst Mfg. Co., H. L. Greenwich, Ohio.
Leggett & Brother, 301 Pearl St., New York. (Hand and power dusting machines.)
Myers & Brother, F. E., Ashland, Ohio. (Hand and power pumps.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting machines.)
Rumsey Pump Co., Ltd., 49 Federal St., Boston, Mass. (Hand and power pumps.)
Spramotor Co., 107-109 Erie St., Buffalo, N. Y. (Hand and power outfits.)
Ward-Love Pump Corporation, Rockford, Ill. (Pumps for all purposes.)

MANUFACTURERS OF INSECTICIDES AND FUNGICIDES.

Blanchard Co., Jas. A., Hudson Terminal Bldg., 30 Church St., New York. (Insecticides and fungicides.)
Bowker Insecticide Co., 43 Chatham St., Boston, Mass. (Insecticides and fungicides.)
Devoe & Raynolds Co., Inc., 101 Fulton St., New York. (Arsenical poisons.)
Frost Insecticide Co., 20 Mill St., Arlington, Mass. (Spray chemicals and apparatus).
General Chemical Co., 25 Broad St., New York. (General insecticides and fungicides, atomic sulphur and B. T. S.)
Glidden Co., Cleveland, Ohio. (Insecticides and fungicides.)
Grasselli Chemical Co., 80 Maiden Lane, New York. (Insecticides and fungicides.)
Heil Chemical Co., Henry, St. Louis, Mo. (Spray chemicals.)
Hemingway & Co., Inc., Bound Brook, N. J. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Kentucky Tobacco Product Co., Louisville, Ky. (Nicotine solution.)
Kil-Tone Co., The, Vineland, N. J. (Insecticides and fungicides.)
Lavanburg Co., Fred L., 100 William St., New York. (Arsenical poisons.)
Leggett & Brother, 301 Pearl St., New York. (Insecticides and fungicides.)
Mechling Bros. Mfg. Co., Line St., Camden, N. J. (Insecticides and fungicides.)
Merrimac Chemical Co., 33 Broad St., Boston, Mass. (Lead arsenate.)

National Color and Chemical Works, Selling Agents for Taylor Chemical Co., 59th St. & 11th Ave., New York. (Carbon disulphide.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting materials.)
Nitrate Agencies Co., 85 Water St., New York. (Arsenical poisons.)
Pratt Co., B. G., 50 Church St., New York. (Miscible oils.)
Riches, Piver & Co., 30 Church St., New York. (Arsenical poisons.)
Robertson Co., The J. T., 147 Richmond Ave., Syracuse, N. Y. (Miscible oils.)
Roessler & Hasslacher Chemical Co., 100 William St., New York. (Cyanide.)
Sherwin-Williams Co., 601 Canal Road, Cleveland, Ohio. (Lime-sulphur and arsenical poisons.)
Smith Co., H. J., Utica, N. Y. (Insecticides and Fungicides.)
Thum Co., O. & W., Grand Rapids, Mich., 15 India St., Boston, Mass. (Tanglefoot.)
Vreeland Chemical Mfg. Co., 50 Church St., New York. (Insecticides and fungicides.)

CONNECTICUT DEALERS IN SPRAYING SUPPLIES.

Dealers in spraying materials can usually be found in each town. Some of the larger firms are mentioned below.

Apothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale druggists.)
Barnes Bros., Yalesville. (Insecticides and fungicides.)
Cadwell & Jones, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)
Grasselli Chemical Co., River St., New Haven. (Insecticides and fungicides.)
Henry & Son, W. A., Blue Hills Farm, Wallingford. (Friend sprayers.)
Jewell, Harvey, Cromwell. (Agent for Hardie hand and power sprayers.)
Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale druggists.)
Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)
Platt Co., The Frank S., 450 State St., New Haven. (Pumps, insecticides and fungicides.)
Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)
Whittlesey Co., The Chas. W., 259-271 State St., New Haven. (Wholesale druggists.)

B

5388 83

University of
Connecticut
Libraries

39153029222850